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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte OSCAR CHI-LIM AU and MING SUN FU

Appeal 2008-1576
Application 09/512,378
Technology Center 2600

Decided: July 29, 2008

Before KENNETH W. HAIRSTON, ANITA PELLMAN GROSS
and KARL D. EASTHOM, *Administrative Patent Judges*.

EASTHOM, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF CASE

Appellants appeal under 35 U.S.C. § 134 from non-final rejections of claims 1-9 and 11-22 (Office Action, mailed Sept. 25, 2006). No other claims are pending. (App. Br. 1). We have jurisdiction under 35 U.S.C. § 6(b).

We affirm-in-part.

Appellants' claimed invention relates to methods for converting pixels having halftone values into pixels having more than two values. (Spec. 2: 18-20; Spec. 4: 20-26).

Independent claim 2, representative of claims on appeal, reads as follows:

2. A method for converting a halftone image having a halftone value for each of a plurality of pixels, into a reconstructed image which for each of said pixels takes on one of more than two possible values, comprising for successive individual pixels:

defining a set of neighborhood pixels of the individual pixel, the set of neighborhood pixels including the individual pixel and additionally a plurality of pixels proximate said individual pixel;

defining for each pixel of the neighborhood, a significance coefficient that is based upon the value of that pixel; and

deriving the reconstructed value of the individual pixel as a sum over the pixels of the neighborhood of a product of the halftone image value at that neighborhood pixel with the significance coefficient of that neighborhood pixel.

The Examiner relies on the following prior art references:

Wong	US 5,506,699	Apr. 9, 1996
Fan	US 6,101,285	Aug. 8, 2000

Claims 2-4, 16, and 19 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Fan.

Claims 1, 5-9, 11-15, 17, 18, and 20-22 stand rejected under 35 U.S.C. § 103(a) as unpatentable over Fan in view of Wong.[1]

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Brief, the Reply Brief, and the Answer for their respective details.[2] In this decision, we have considered only those arguments actually made by Appellants. Arguments which Appellants could have made but did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c) (1) (vii).

PRINCIPLES OF LAW

Anticipation

Appellants have the burden on appeal to the Board to demonstrate error in the Examiner's position. *See In re Kahn,* 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can overcome a rejection [under § 103] by showing insufficient evidence *of prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.") (quoting *In re Rouffet,* 149 F.3d 1350, 1355 (Fed. Cir. 1998)). Appellants may sustain this burden by showing that the prior art reference relied upon by the Examiner fails to disclose an element of the claim. It is axiomatic that anticipation of a claim under § 102 can be

[1] The Examiner rejected claims 6-9 as obvious essentially over the collective teachings of Fan and Wong, employing an "obvious engineering design choice" rationale. (Ans. 14).
[2] The Examiner withdrew initial rejections under 35 U.S.C. §§ 101 and 112 (first and second paragraphs). (Ans. 2).

found only if the prior art reference discloses every element of the claim. *See In re King*, 801 F.2d 1324, 1326 (Fed. Cir. 1986); *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1458 (Fed. Cir. 1984).

<u>*Obviousness*</u>

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that "there was an apparent reason to combine the known elements in the fashion claimed." *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727, 1740-41 (2007). Such a showing requires "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *Id.*, 127 S. Ct. at 1741 (quoting *In re Kahn*, 441 F.3d 977, 987 (Fed. Cir. 2006)).

If the Examiner's burden is met, the burden then shifts to the Appellant to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992).

ANALYSIS

Anticipation

With respect to claims 2-4, 16, and 19, Appellants' arguments focus on representative claim 2. Appellants dispute (App. Br. 15) the Examiner's determination (Ans. 3-4) that Fan teaches the significance coefficient for each pixel as called for in the final two steps of the method set forth in claim 2, namely:

> deriving for each pixel of the neighborhood, a significance coefficient that is based upon the value of that pixel; and
>
> deriving the reconstructed value of the individual pixel as a sum over the pixels of the neighborhood of a product of the halftone image value at that neighborhood pixel with the significance coefficient of that neighborhood pixel.

The Examiner takes two alternative positions (Ans. 16-18). Appellants dispute the Examiner's first position that α constitutes the claimed significance coefficient. However, Appellants do not challenge the Examiner's second position that Fan's coefficients α, 1 - α, and 0 meet the claimed significance coefficients (Ans. 17-18, *see* Fan, Fig. 7A). Appellants state, regarding the first position, that "the Fan patent does not disclose that

the reconstructed value of a pixel is a sum of products of the type recited in the claim" (App. Br. 15-16), arguing:

> First, as discussed previously, the value α does not represent a significance coefficient associated with a given neighborhood pixel. Rather, it is a constant value that is independent of any particular neighborhood pixel.
>
> Second, even if the value α could be considered to be a significance coefficient, the Fan patent does not disclose the calculation of the product of that value with a particular neighborhood pixel. Rather, the value for α is multiplied by the average gray level input value for all of the pixels in a window, i.e. x*(m,n). The value α is not multiplied by individual pixels, as recited in the claim.

(App. Br. 16).

Regarding the first argument, Appellants further contend that "[t]he patent does not disclose that the value α is derived for *each* pixel of a neighborhood, based upon the value of *that* pixel." (App. Br. 15). Instead, α "is a fixed value that is selected once, and globally applied to all edge enhancement calculations." (App. Br. 15). We are persuaded by this contention. We agree that Fan does not teach that α is based on the value for each pixel, as Fan describes the value of α as set in order to determine how greatly the edges will be enhanced (Fan, col. 7, ll. 48-58). However, as indicated above, Appellants' contention does not address the Examiner's alternative second position that Fan teaches that the coefficients are either 0, α, or 1-α. (*See* Ans. 17-18, Reply Br. 2-3). As Appellants' have not pointed to error in the Examiner's unchallenged finding, Appellants have not met their burden on appeal.

We find that Fan reasonably discloses the claimed significance coefficients generally as proposed by the Examiner. For claim 2, we find, in congruence with the Examiner's line of reasoning (Ans. 17-18), an "individual pixel" $x^*(m, n)$ with coefficient $1\text{-}\alpha$, and the "plurality of pixels proximate said individual pixel": $x^*(m\text{-}T_x, n)$ and $x^*(m + T_x, n)$, each with either the coefficient 0 or α (Fan, col. 6, l. 48 to col. 7, l. 63; Fig. 4, Fig. 8A, Box 316).

Therefore, summing the products yields the reconstructed value of the pixel $y(m, n)$: the sum of products $(1\text{-}\alpha)\ x^*(m, n)$ plus either $\alpha x^*(\ m\text{-}T_x, n)$ or $\alpha x^*(\ m + T_{x,,}\ n)$ - depending on the difference between the relative absolute values of dif0 and dif1. (*See* Fig. 7A, Fig. 4, Box 308, 316). In other words, according to the Examiner, the reconstructed value of $y(m, n)$ can be represented as one or the other of the two sums of products:

(1) $y(m, n) = [1\text{-}\alpha]\ x^*(m, n) + [\alpha]x^*(\ m\text{-}T_x, n)\ +\ [0]\ x^*(\ m + T_x, n)$

(2) $y(m, n) = [1\text{-}\alpha]\ x^*(m, n) + [0]x^*(\ m\text{-}T_x, n)\ +\ [\alpha]\ x^*(\ m + T_x, n)$.

We note that Fan does not explicitly disclose a multiplication step involving the product 0. However, Appellants do not argue Fan does not teach multiplying by 0, nor does the claim recite an explicit multiplication step. We also note that claim 2 requires "defining *a set* of neighborhood pixels . . . [and] deriving *for each* pixel," but calls for "deriving the reconstructed value . . . as a sum over *the* pixels of the neighborhood of a product . . ." (emphasis added). Thus, deriving a product for only two

pixels in the neighborhood satisfies the claim, since the claim does not recite a sum over each pixel in the set of all neighborhood pixels.[3]

Which equation filters the input pixels x (m, n) depends on the differences between the absolute values of dif0 and dif1. (*See* Fig. 7A, Fig. 4, Box 316). The bracketed values [0], [α] and [1-α] represent the claimed significance coefficients for each of the pixels in the neighborhood (m, n). Thus, the significance coefficient for each of the right-hand neighbor pixel x*(m + T_x) and left-hand neighbor pixel x*(m-T_x) (*see* Fig. 8A) takes on one of two values, 0 or α, ultimately depending on the value of that right or left-hand pixel, because the value of each neighborhood pixel x*(m, n), x*(m + T_x, n), and x* (m-T_x, n) determines the value of dif0 and dif1 according to Box 308 in Figure 4 of Fan, as the Examiner found (Ans. 17-18).

Accordingly, each neighborhood significance coefficient, designated here respectively as Nr and Nl for the right and left-hand pixels, is derived for each to be either 0 or α, so that Nr and Nl are "based upon the value of that pixel," as set forth in claim 2. The neighborhood coefficient, designated here as Nc, for the "individual pixel," x*(m, n), is also derived "based upon the value of that pixel." The value Nc above in Equations 1 and 2 is derived

[3]An explicit multiplication step involving 0 is not required for another reason. That is, because 0 times any other value yields 0, "deriving," as claimed, may involve a simple algorithm or mental step which eliminates the unnecessary multiplication step: i.e., if 0 is a coefficient or value, then the product is 0. Alternatively, even if such a multiplication step is required for more than two pixels, we find that each of Fan's pixel windows comprises three neighborhood pixels, each of which is multiplied by either [1-α] or [α], thereby the three (or six) neighborhood pixels, as multiplied, meet the claim. (*See* n. 4, 6 *infra*, and Equations 1 and 2 *supra*).

to be 1-α. But, the value is not always 1-α. For example, Nc becomes 1 when Box 312 (Fig. 4) filters the pixels.[4] Which box filters the pixel and thus dictates the value of the respective significance coefficient depends ultimately on the values of dif0 and dif1 which depend on the value for each pixel in the neighborhood (Fig. 4, *see* Boxes 308, 310, and 313).

In other words, inspection of the function y(m, n) = f [x (m, n), x*(m, n), x*(m - $T_{x,}$, n), x*(m + T_x, n)] at Figure 4, Box 316, reveals that y(m, n) (i.e., the "reconstructed value"), can be represented as one equation or function of the values of the pixels in the neighborhood. Hence, while the

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[4] The value is 1 when the group of pixels at window x(m, n) is considered one pixel having an average value x* (m, n). On the other hand, considering each pixel in the window x (m, n) at Box 312 as one pixel yields the significance coefficient value as 1/3. That is, the three binary pixels at pixel window x (m, n) (*see* Fig. 8A) are multiplied by 1/3 to yield the average x*(m, n), which becomes the reconstructed value of the individual pixel, y(m, n). (*See also* n. 6 *infra*).

Consequently, the reconstructed value y(m, n) is derived as a sum over the three individual binary pixels in the neighborhood x(m, n) of the product of the halftone image values (for example, (1,0,1)) with the significance coefficient 1/3 yielding y(m, n) = x*(m, n), representing "continuous" pixels (1/3, 1/3, 1/3) (*see* Fig. 8A, Fig. 4, Box 312). Hence, the claim is also met under this alternative interpretation. (While the neighborhood coefficients at Box 312 are each 1/3 (to yield the average x*(m, n) over three pixels), Box 314 and Box 316 have different coefficients for the individual pixels x(m, n), depending on the values of differences between the "non-neighbors" at (m-T_x, n) and (m + T_x, n) and the set of three individual pixel neighbors at (m, n); hence, each Box represents a derivation of a different coefficient (i.e., 1 for Box 314, 1/3 for Box 312, and (1 – α)/3 for Box 316) for the neighborhood binary pixels at (m, n), based ultimately on the binary values of each of the three individual neighbor pixels in the set (101), (111), etc. *within* a pixel window x(m, n)). Fig. 3 similarly has two different coefficients: 1 for Box 214 and 1/3 for Box 212, thereby meeting the claim.

function is represented in Box 316 of Figure 7A as two equations, those two also could be represented more succinctly as one equation, as follows:

(3) $y(m, n) = Nc\ x^*(m, n) + Nr\ x^*(m + T_x, n) + Nl\ x^*(m-T_x, n)$

Equation 3 represents a general formula for the filter(s) in Figure 4, encompassing Boxes 310, 312, 313, and 316, where the significance coefficients Nc, Nr, and Nl are step functions (i.e., each having at least two of a finite set of values (i.e., α, $1-\alpha$, 0, 1) that vary according to the values of pixels of the neighborhood, as explained above, and are, accordingly, derived "based upon the value of that pixel," as set forth in the claim.

We turn to Appellants' second argument quoted above on the top of page 6 of our Opinion, that Fan teaches multiplying α by the *average gray value* of one of the neighborhood pixels $x^*(m - T_x, n)$ or $x^*(m + T_x, n)$, but does not teach multiplying by an *individual* pixel, as claimed.[5] (App. Br. 16). We disagree. Appellants do not explain why the average gray value cannot define the value of Fan's neighborhood pixel. Appellants do not specifically argue that the claimed pixels, or halftone values, must be binary. Nor does the claim recite a product with a binary pixel. Rather, the claim refers to "the reconstructed value of the individual pixel as a sum over the pixels of the neighborhood of a product of the *halftone image value* at that neighborhood pixel . . ." (the "individual" pixel as recited simply distinguishes a pixel from the plurality in the neighborhood). (Emphasis added, *compare* Spec. 4:25-26 "the binary values referred to may be values which can only ever be 0 or 255").

[5] While this contention was directed to the Examiner's first position based on α alone, we address it here and apply it to the Examiner's alternative position based on α, $1-\alpha$, and 0.

Thus, Fan's pixel window, containing three pixels, and referred to as a pixel having halftone gray values, reasonably meets the claimed pixel. (*See* Fan, describing "halftone image data which include gray level values *for each pixel* in scanline n" (col. 8, ll. 35-36)). Accordingly, Appellants' argument is not persuasive.[6]

In sum, Appellants have not demonstrated error in the Examiner's findings. Accordingly, we will sustain the Examiner's rejection of claim 2. We also sustain the rejection of claims 3-4 and 19 which Appellants do not argue separately.

Obviousness

Claims 1, 18, and 22

Similar to the issue involved above, the dispute over independent claims 1 and 22 involves whether Fan discloses "weighting values . . . derived from the binary values of the halftoned image" as called for in representative claim 1 (Ans. 18, App. Br. 17). We generally agree with the Examiner that Fan's weighting values constitute different weight values for each pixel in a neighborhood as set forth in representative claim 1. Notwithstanding Appellants argument to the contrary (App. Br. 17), we also

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[6] We also agree with the Examiner's unchallenged position that even if the pixel window at (m, n) is considered as a group of (three) pixels, rather than an individual pixel, each pixel in the group would be multiplied by the coefficients (Ans. 18). Similar remarks apply to each pixel or group at m - T_x and m + T_x, as the Examiner indicated (Ans. 18). *See* Figure 8A, revealing a pixel pseudo window 706 of length Tx encompassing three pixels. Averaging is accomplished in box 306 of Figure 4. We infer, for example, if the binary sequence is (101), the average value is 2/3 for that window, yielding a gray pixel window x*(m, n) = (2/3, 2/3, 2/3).

find that the weighting values are determined by the binary values of the halftoned image, thereby meeting claim 1.[7]

Appellants' argument that the difference values determine only which pixel window value (i.e., right or left) is added but that "the value for α remains the same" (App. Br. 17) does not address the Examiner's second position, described above with respect to claim 2, that either α or 0 forms a product Nr and Nl with the right or left neighborhood pixel window. Similarly, as indicated above, either 1 - α, 1/3, or 1 forms a product Nc with the individual pixel x(m, n). So, even though α is constant, each of the neighborhood coefficients Nr, Nl, and Nc (*see* Eq. 3 *supra*) changes as a function of the difference between adjacent pixels in the neighborhood, and hence, is "derived from the binary values of the halftoned image," as set forth in claim 1. That is, similar to our finding above, the binary values determine the average values which determine the difference values, dif0 and dif1, which, in turn, determine the values of Nr, Nl, and Nc, thereby deriving each coefficient from the binary values of the halftoned image, as set forth in the claim.

Appellants also argue that Wong's teaching of using binary values would destroy the purpose of Fan's teaching (App. Br. 17-18). We find otherwise. As we found above, Fan uses binary values to obtain average values which are employed to derive the weighting values in the manner set forth in the claim. Therefore, Wong's cumulative teachings do not destroy the purpose of Fan.

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[7] The Examiner applies Wong to teach binary values and iterative processes, but relies on Fan to teach that weighting values are derived from non-binary pixel values. (Ans. 6-7). We find Wong's teaching to be cumulative.

Appellants also argue that applying Wong's iterative teaching to Fan would also destroy the purpose of Fan. (App. Br. 18). Again, we find otherwise. We find that Fan teaches iterative processing in the manner set forth in the claim. (*See generally*, Fan, col. 7, l. 64 to col. 8, l. 38). For example, the output of filter 104 (Fig. 4) feeds the input to filter 106 (Fig. 5). (*See* box 106, Fig. 4). "Those skilled in the art will also recognize that the embodiment of the invention described with reference to FIG. 10 *enables the image to be filtered more than twice*." (Fan, col. 8, ll. 13-16, emphasis added). (Figure 10 applies to Figures 3-6 (col. 8, ll. 25-30)). Therefore, Wong's cumulative teachings do not destroy the purpose of Fan.

Accordingly, we will sustain the Examiner's rejection of claims 1 and 22. We will also sustain the Examiner's rejection of dependent claim 18, not separately argued.

<u>Claims 13 and 20</u>.

For representative claim 13, the dispute similarly revolves around whether selecting Fan's α (and thus deriving 1-α) constitutes '"for each pixel of said first neighborhood, deriving a *respective* significance coefficient.'" Appellants argue: "The use of the term 'respective' means that each pixel of the neighborhood has its own significance coefficient derived for it." (App. Br. 18). Again, similar to the issues discussed above, Appellants focus on the single coefficient α, and fail to challenge the Examiner's general finding that Fan discloses a set of coefficients, which depend on binary values in the pixels x(m, n) and its neighbors, and which we have found to be 1, 0, α, α/3 and (1-α). Even if some of the neighbors have the same coefficient value (which they do not when pixel windows are considered pixels), the recitation

of "respective" does not preclude that. For example, neighbors can each have his or her house valued at the same "respective" price.

We also are not persuaded by Appellants' argument that Fan only teaches multiplying the coefficients by the average gray value. As we discussed above with respect to claim 2, Appellants' claims do not preclude such a product. Fan's disclosure, relating halftone values as including gray values (col. 8, ll. 34-38), constitutes evidence that "halftone" does not require a binary value.

On the other hand, even if the claim requires multiplying products by binary values, Fan meets the claim. That is, each of Fan's reconstructed values y(m,n) = x*(m, n) or x (m, n) (Fig. 3, Boxes 212, 214; Fig. 4, Boxes 312, 314) implies a sum of different products of respectively 1/3 or 1 times each binary pixel in the window x(m, n), thereby meeting the claim (*see* n. 4, 6 *supra*).

Still further, for Figure 4, Fan reasonably teaches that such an average, or sum of products, may occur after multiplying by one of the different coefficients 1, 0, α, or (1-α), because, for example, the notation α x*(m-T_x, n) + (1-α) x* (m, n) yields the same value regardless of whether averaging, which includes summing, is performed before or after multiplying by the significance coefficients α or (1-α).[8] In other words,

[8] Similarly, as indicated above, Fan, in box 316 (Fig. 7A), effectively assigns the coefficient 0 to the left pixel neighbor x(m - T_x, n) for the "OTHERWISE" condition (Fig. 7A). On the other hand, for the other condition - when the absolute value of dif1 is less than that of dif0 - Fan effectively assigns the coefficient 0 to the right pixel neighbor x(m +T_x, n). Multiplying (if multiplying is required) 0 by each bit in the pixel achieves the same result as averaging, and then multiplying by 0.

altering the order of such a mathematical operation to obtain the same result, if not implicit in the equation, would have involved no more than the predictable rearrangement of notoriously well known mathematical steps implicated in the cumulative, distributive, and/or associative properties.

We are also not persuaded by Appellants' arguments that Fan does not teach "further iterations" as called for in claim 13 (App. Br. 19). We have already found that Fan explicitly teaches such iterations. Appellants argue that there is no suggestion "to rederive a significance coefficient during each iteration" because "there is no suggestion to change the value of α from one iteration to the next." (App. Br. 19). While we agree, as noted above, that the value of α does not change from one iteration to the next, we find, for reasons related to those we also explained above, that the values of dif0 and dif1 change for each iteration because different inputs result from the filtering at each iteration (*see* col. 7, l. 63 to col. 8, l. 30), which thus changes which coefficient, 1, 0, α, or (1-α), is applied, constituting a new derivation in the manner claimed (i.e., coefficients Nr, Nl, and Nc, Eq. 3 *supra*, change). Further, since in one embodiment, first the rows and then the columns are filtered, such an iteration necessarily involves different x(m, n) values and, hence, different values of dif0 and dif1 (*see id.*).

Claims 14, 15, 17, and 21

Appellants' arguments for representative claim 14 incorporate the arguments discussed above with respect to claims 13 and 20, namely, the arguments directed to the claimed steps of "deriving for each pixel of the neighborhood, a significance coefficient that is based upon the value of that pixel" and "deriving …as a sum …of a product. . . ." Accordingly, for

reasons noted above, we will also sustain the Examiner's rejection of these claims.

Claims 5 and 11-12

Appellants do not make separate patentability arguments for these claims. Accordingly, these claims fall with claim 1.

Claims 6-9

We are persuaded by Appellants' arguments that the Examiner has not established that Fan teaches, or suggests with Wong, (App. Br. 20-21), that each significance coefficient of Fan constitutes decreasing functions. We do not find support for the Examiner's position that as a matter of design choice, one could modify α so that it becomes a decreasing function, because it is an increasing function (Ans. 21). We have already found, as explained above, that α is a constant. Fan does not disclose how it is controlled or derived. Accordingly, we will not sustain the Examiner's rejections of claims 6-9.

New Ground of Rejection Under 37 C.F.R. § 41.50(b)

We hereby enter a new ground of rejection under 37 C.F.R. § 41.50(b) for claims 1-9 and 11-22.

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 1-9 and 11-22 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter for the reasons that follow.

Under § 101, four categories of subject matter are eligible for patent protection: (1) processes; (2) machines; (3) manufactures; and (4) compositions of matter. 35 U.S.C. § 101. While the scope of patentable subject matter encompassed by § 101 is "extremely broad" and intended to "include anything under the sun that is made by man," it is by no means unlimited. *In re Comiskey*, 499 F.3d 1365, 1375 (Fed. Cir. 2007) (quoting *Diamond v. Chakrabarty*, 447 U.S. 303, 308 (1980)). For example, laws of nature, abstract ideas, and natural phenomena are excluded from patent protection. *Diamond v. Diehr*, 450 U.S. 175, 185 (1981).

It is the second exclusion noted above - abstract ideas (which include algorithms) - that is relevant to the new ground of rejection. As the U.S. Supreme Court has noted, "'[a]n idea of itself is not patentable[]'. . . .'A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right.'" *Id.* at 185 (citations omitted). Additionally, our reviewing court recently articulated the following two distinct aspects of abstract ideas:

> First, when an abstract concept has no claimed practical application, it is not patentable….Second, the abstract concept may have a practical application….In [the context of industrial processes], the Supreme Court has held that a claim reciting an algorithm or abstract idea can state statutory subject matter only if, as employed in the process, it is embodied in, operates on, transforms, or otherwise involves another class of statutory subject matter, i.e., a machine, manufacture, or composition of matter. . . . Thus, a claim that involves both a mental process

> and one of the other categories of statutory subject matter (i.e., a machine, manufacture, or composition) may be patentable under § 101. . . . For example, we have found processes involving mathematical algorithms used in computer technology patentable because they claimed practical applications and were tied to specific machines.

Comiskey, 499 F.3d at 1376-77.

The court in *Comiskey* further noted:

> [Section 101] does not allow patents to be issued on particular business *systems*…that depend entirely on the use of mental processes. In other words, the patent statute does not allow patents on particular *systems* that depend for their operation on human intelligence alone….Thus, it is established that the application of human intelligence to the solution of practical problems is not in and of itself patentable.

Id. at 1378-79 (emphasis added).

With these legal principles in mind, we turn to the invention.

Appellants summarize the claimed subject matter as follows:

> V. Summary of Claimed Subject Matter
>
> The claimed subject matter is directed to the enhancement of images on a pixel-by-pixel basis. As described in the background portion of the application, one exemplary application of the invention is a process known as "inverse half toning", in which binary pixel values for an image are converted into values within a continuous range, e.g. 0-255. Preferably, this method is carried out in an iterative fashion, in which a pixel value resulting from one iteration is updated in a successive iteration. (Page 3, lines 18-25). The updating that

> occurs during each iteration is succinctly described by the equation set forth on page 6, line 28 of the application, namely:
> . . . .

(App. Br. 1).

Appellants *admit that their claim is directed to the manipulation of data*, stating: "Claim 1 is not directed to the manipulation of *any* kind of data." (App. Br. 7 – as argued prior to the Examiner's withdrawal of the rejection on appeal – *see* n. 2, *supra*). Appellants also argue that "[t]he fact that the individual pixels can be represented by data does not automatically transform the subject matter into an abstract idea." (*Id.*)

Appellants' admissions that mere data conversion is involved are buttressed by the Specification:

"Firstly, as mentioned, a preprocessing may be carried out (e.g. *according to a known filter algorithm, such as a low pass filter*) to produce a set of initial values *to which the algorithm described above* is applied." (Spec. 4: 6-8, emphasis added).

"In general terms the invention proposes that the continuous value for any given pixel is chosen taking into account the halftone value of each of a set of pixels near the given pixel." (Spec. 2: 18-20). "As used in this document the term 'continuous value' of an image pixel is used to mean a value which is not binary, but is rather selected from one of a number of predetermined possibilities . . . such as one of 256 possibilities." (Spec. 4: 20-24).

Hence, according to Appellants' description of their claimed invention, Appellants merely convert binary data values "for an image" to "continuous values" (i.e., digital n-ary values greater than 2), employing an algorithm. No *image conversion* is claimed. Without an image input and output claimed, no image can be enhanced, contrary to Appellants' description in their Appeal Brief as quoted above. Converting pixel values involves no more than converting numbers in an array containing those values. "The original image is an array in which the pixels are labelled by indices i and j." (Spec. 6: 1-2).

Additionally, such a process can be performed mentally. One of skill, starting with an image of three pixel binary dots, or a set of binary values in an array, which the claims do not preclude, can perform the algorithm without a computer. Accordingly, Appellants' reliance on *Arrhythmia Research Technology v. Corazonix Corp.*, 958 F.2d 1053 (Fed. Cir. 1992) is misplaced for at least two reasons (*see* App. Br. 7). First, for example, in claim 1, one can mentally define for each pixel or binary number, a neighborhood, and then apply the algorithm as set forth in the remaining claim steps. Similar remarks apply to the claims 2-9 and 11-16. The pixels, as claimed, require no more than the mathematical manipulation of an array of data which can be performed mentally.

Second, even if Appellants' claims require more than mental steps, the method claim in *Arrhythmia* involved the processing of real time changing signals and conversion thereof as opposed to mere manipulation of static data stored in an array. *Id.*, at 1055 (*see* claim 1 reciting, in part, "converting a series of QRS signals to time segments, each segment having a

digital value equivalent to the analog value of said signals at said time"). In other words, the method claim in *Arrhythmia* requires a physical transformation.

In contrast, Appellants' claims are not tied to a specific machine, nor do they render a physical transformation. Alternatively, they involve purely mental steps.

While claim 12 recites a low pass filter, such a filter, as Appellants disclose as noted above, is invariably simply a computer algorithm involving the mere recitation of simple mathematical steps which either could be performed mentally or involve mere computer data manipulation.

While some of the claims nominally recite a machine or apparatus, none of the claims require a transformation of anything more than data, and thus do not involve the transformation of an input to an output, into a different physical state, as required by our reviewing courts. Thus, the filtering of claim 17, the receiver of claim 22, and the computer program products of claims 18-21, do not save the claims, for reasons as further explained below.

In *Gottschalk v. Benson*, 409 U.S. 63, 73-74 (1972), one of the method claims, claim 8, recited a shift register. Such a claim was held nonstatutory, despite the shift register, because the claims recited mere data conversion – involving a conversion of binary coded decimal (BCD) to pure binary. Accordingly, the mere recitation of a computer product, filter, or receiver, as recited in the claims noted, without more, does not save an algorithm which does no more than operate on data to produce a different array of numbers. "Transformation and reduction of an article to 'a different

state or thing' is the clue to the patentability of a process claim that does not include particular machines." *Benson*, 409 U.S. at 70. *Cf. Comiskey* at 1377 (describing *Arrhythmia* as "holding patentable a method for analyzing electrocardiograph signals for the detection of a specific heart condition that used 'electronic equipment programmed to perform mathematical computation'")). *See also In re Walter,* 618 F.2d 758, 764 (C.C.P.A. 1980), distinguishing *In re Johnson,* 589 F.2d 1070 ("Operation of the claimed process in Johnson converted the noise-containing physical seismic record present at the start to a new record minus the noise component.").

In sum, the claims involve the mere conversion of static data numbers, as Appellants concede, similar to the shift register claim held nonstatutory in *Benson*, or involve purely mental steps, similar to the claims held nonstatutory in *Comiskey*.

CONCLUSION

We conclude that the Examiner erred in rejecting claims 6-9. Accordingly, we will not sustain the Examiner's rejections of those claims. On the other hand we have sustained the Examiner's rejections of claims 1-5 and 11-22. We have also entered a new ground of rejection for claims 1-9 and 11-22.

DECISION

We affirm the Examiner's decision rejecting claims 1-5 and 10-22. We reverse the Examiner's decision rejecting claims 6-9. We have also entered a new ground of rejection under 37 C.F.R. § 41.50(b) for independent claims 1-9 and 11-22.

This decision contains a new ground of rejection pursuant to 37 C.F.R. § 41.50(b) (effective September 13, 2004, 69 Fed. Reg. 49960 (August 12, 2004), 1286 Off. Gaz. Pat. Office 21 (September 7, 2004)). 37 C.F.R. § 41.50(b) provides "[a] new ground of rejection pursuant to this paragraph shall not be considered final for judicial review."

37 C.F.R. § 41.50(b) also provides that the Appellants, <u>WITHIN TWO MONTHS FROM THE DATE OF THE DECISION</u>, must exercise one of the following two options with respect to the new ground of rejection to avoid termination of the appeal as to the rejected claims:

> (1) *Reopen prosecution.* Submit an appropriate amendment of the claims so rejected or new evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the proceeding will be remanded to the examiner. . . .
>
> (2) *Request rehearing.* Request that the proceeding be reheard under § 41.52 by the Board upon the same record. . . .

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

<u>AFFIRMED-IN-PART</u>

<u>37 C.F.R. § 41.50(b)</u>

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